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Supine vs. Prone Positioning for Breast Radiation

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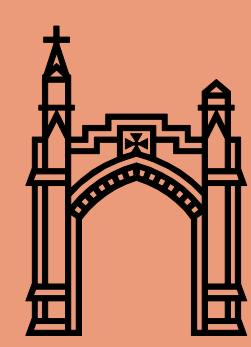
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Supine vs. Prone Positioning for Breast Radiation Therapy

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INTRODUCTION

- Breast cancer is one of the most common cancers that occur in the United States.
- Due to advances in cancer diagnosis, breast cancer is often diagnosed earlier causing patients to be treated faster and live longer.
- These patients are at greater risk for developing long-term complications.
- There is not a definitive best way to position breast cancer patients for their treatment to help reduce these complications.

WHAT IS RADIATION THERAPY?

- It is one of the three principle modalities used to treat cancer.
- Cancer involves an unregulated, uncontrolled replication of cells, making it highly susceptible to ionizing radiation.
- Radiation therapy delivers high doses of ionizing radiation precisely to the tumor while limiting the dose received by the normal, healthy tissue.

(Long, Rollins, & Smith, 2016)

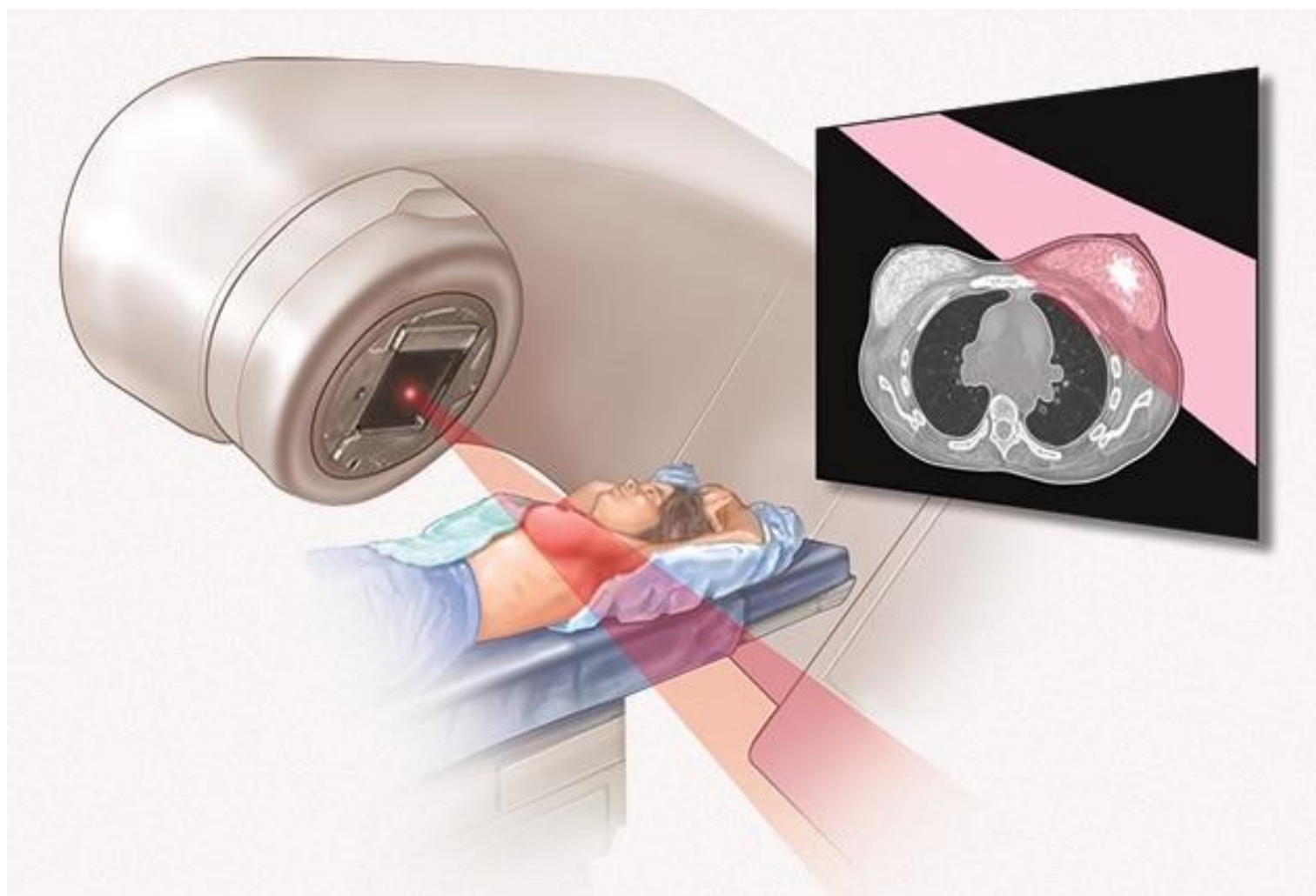


Figure 1: (Mayo Clinic, 2018)

BREAST CANCER TREATMENT

- Breast cancer patients are treated with a multidisciplinary approach that includes surgery, radiation therapy, and chemotherapy.
- Radiation therapy drastically reduces the risk of local cancer reoccurrence in most patients.
- Radiation treatment for breast malignancy is one of the most technically challenging procedures performed in the radiation oncology department.
- Breast anatomy varies widely among patients.
- Along with breast tissue, the chest wall, nearby lymph nodes, and supraclavicular areas are often treated as well, depending on the patient.
- Identical daily positioning of the patient is crucial to ensure the treatment area receives the correct dose during each treatment.

(Washington & Leaver, 2016)

CONCERNS WITH TREATMENT

- Treatment of left-sided cancers results in increased risk of cardiac toxicity, cardiac diseases, and ischemic heart events.
- It is important to find treatment techniques that will lower the dose to the cardiac components without compromising target tumors volume. (Saini, Hwang, Biagioli, & Das, 2018)

SUPINE POSITIONING

- The patient lies on back in selected immobilization device with both arms elevated above their head, resting on the device.
- The device is often on an incline, with the patient's head and thorax slightly elevated.
- The patient's chin is lifted, and arms are positioned to minimize skin folds surrounding the breast tissue.
- The head is turned away from the treatment side.

(Washington & Leaver, 2016)

PRONE POSITIONING

- The patient lies on stomach on breast board with both arms elevated alongside their head.
- The affected breast falls through an opening in the breast board.

(Washington & Leaver, 2016)

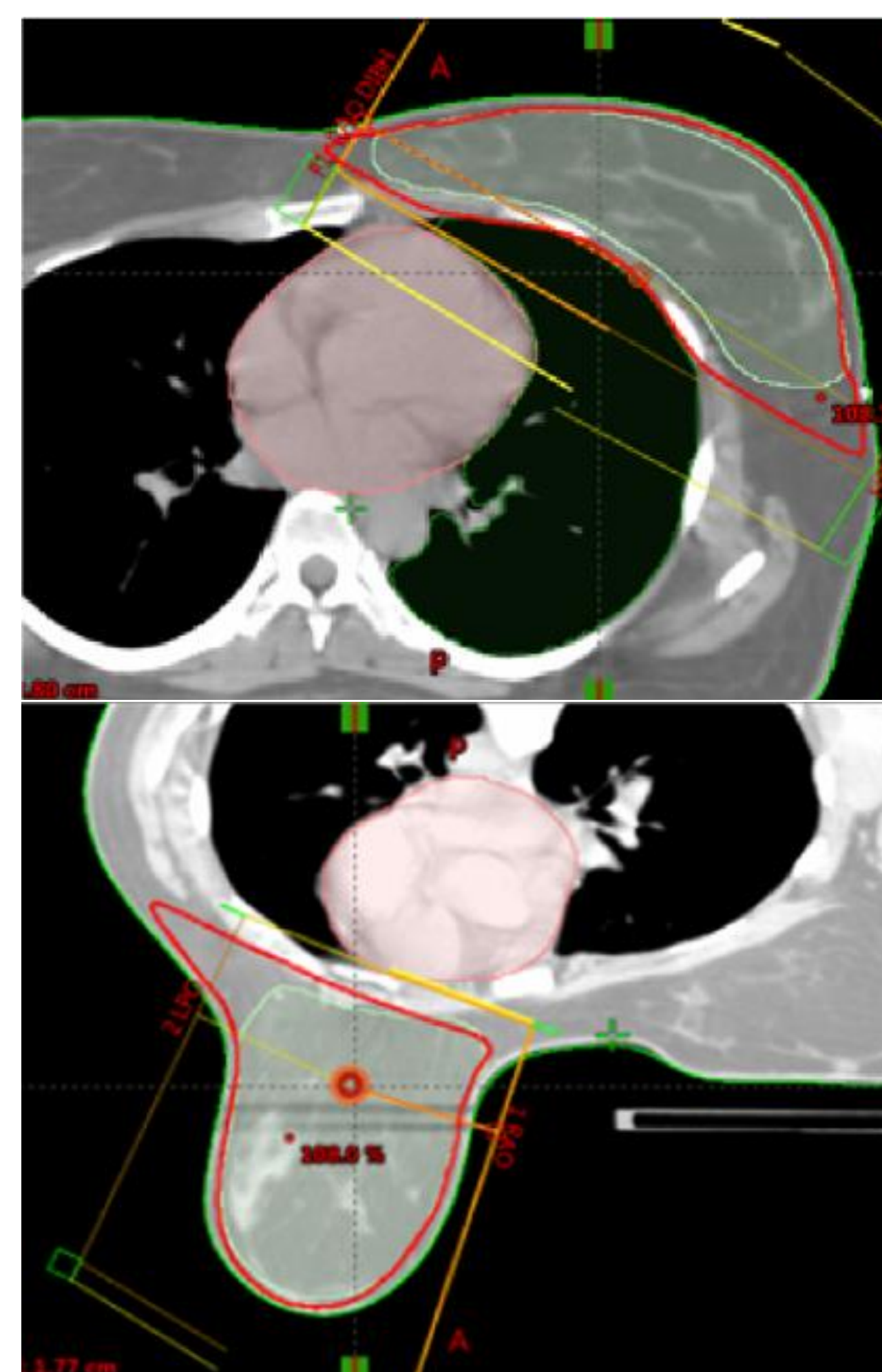


Figure 2 (top): Example of supine setup on CT slice with target volume and heart contoured (Saini et al., 2018, p. 4).

Figure 3 (bottom): Example of prone setup on CT slice with target volume and heart contoured (Saini et al., 2018, p. 5).

RESEARCH FINDINGS

SUPINE POSITION

- Better suited for small-breasted patients.
- Preferred treatment if chest wall and regional lymph nodes need to be treated.
- For left-sided breast treatment, supine deep inspiration breath hold has found to have the same dose reducing effects of prone positioning.

(Saini et al., 2018)

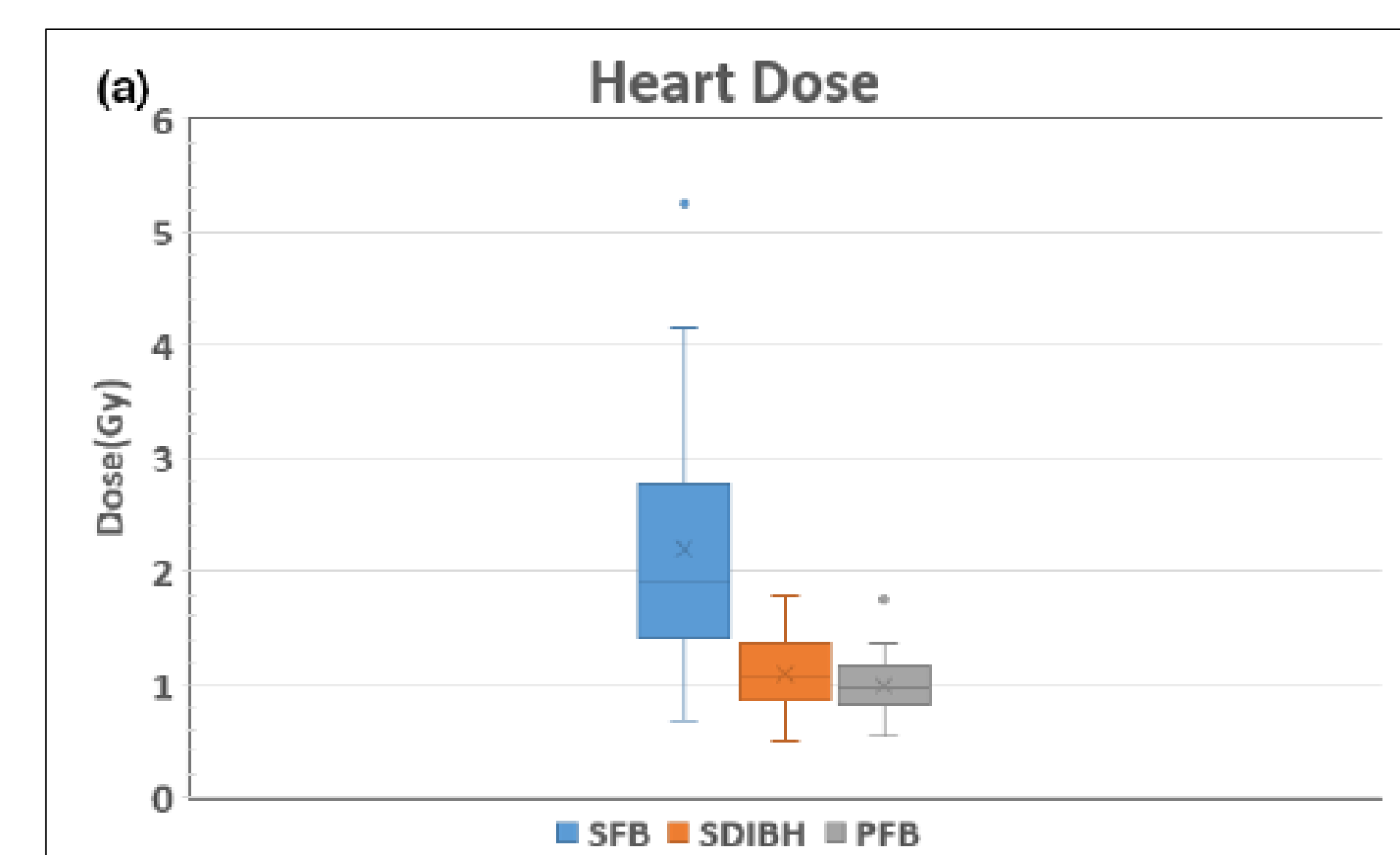


Figure 4: Box-whisker plot of dose to heart in supine free breathing (SFB), supine deep inspiration breath-hold (SDIBH), and prone free breathing (PFB) techniques for left-sided breast cancers. Heart dose is significantly lower with SDIBH and PFB techniques (Saini et al., 2018, p. 6).

PRONE POSITION

- Better suited for large-breasted patients.
- Delivers lower lung and heart doses compared to supine. (Saini et al., 2018)
- Position cannot be used if the chest wall and regional lymph nodes need to be treated.
- Immobilization device obstructs anterior beam access to regional lymph nodes.
- Position has decreased repositioning accuracy. (Kahan et al., 2018)

CLINICAL METHOD FOR PREDICTING THE BENEFIT OF PRONE VS. SUPINE POSITIONING

- Statistical model uses three anatomical determinants of the patient to accurately estimate the benefits of one position over the other by means of heart doses.
- Method worked successfully for 98% of tested patients.
- Tool is recommended for use in facilities that employ prone positioning. (Kahan et al., 2018)

PRONE-CRAWL POSITION

- Patient is prone with both arms alongside their body and head turned away from affected side.
- The unaffected breast is pulled laterally away from affected breast.
- Allows for the treatment of regional lymph nodes, unlike conventional prone positioning. (Deseyne et al., 2017)

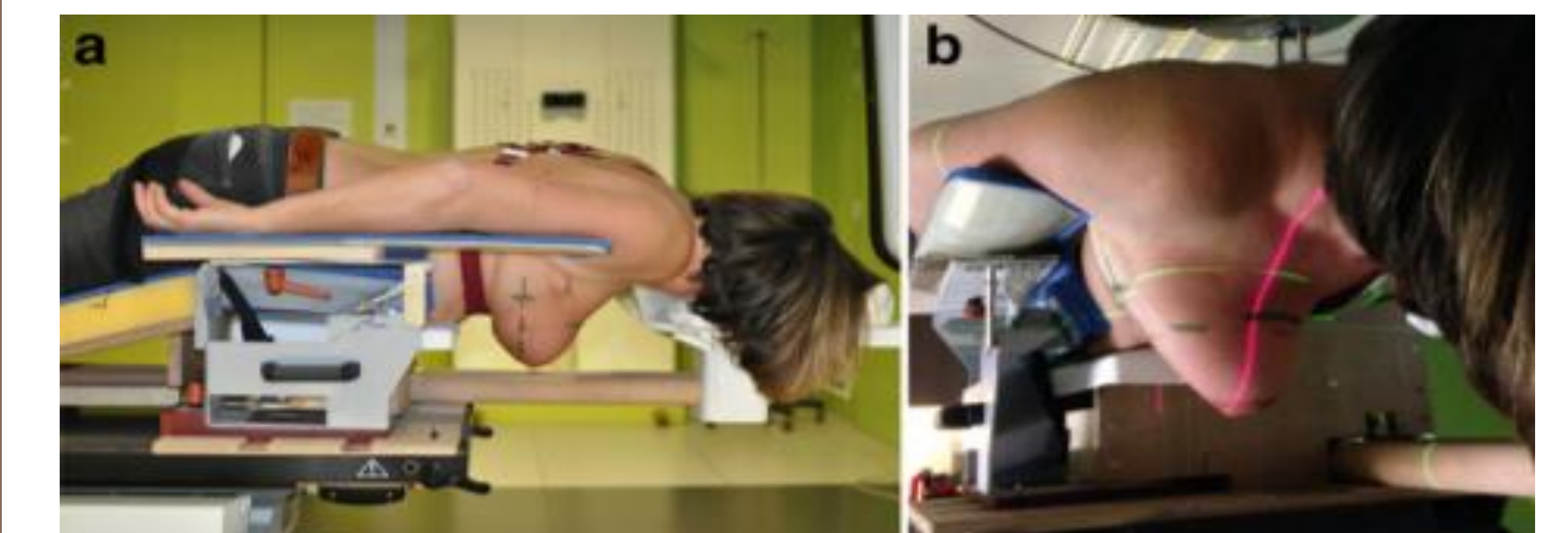


Figure 5: Patient setup on a crawl couch in the prone-crawl position (Deseyne et al., 2017, p. 2).

CONCLUSION

- Positioning for breast cancer treatment should be determined on a patient-by-patient basis.
- Each patient varies in breast anatomy, tumor biology, and location.
- Radiation doses to the heart should be of main concern and try to be minimized as much as possible, without compromising dose to the target volume.
- Additional measures like breath-hold and respiratory gating can be employed to further reduce the dose to the heart.

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